

Claims

1. A mechanism for causing a flow of liquid crystal comprising:

a channel defined by at lease one wall surface;

liquid crystal which is put in the channel and movable along said at least one wall surface; and

a means for applying an electric or magnetic field to the molecules of the liquid crystal to turn them in a plane intersecting said at least one wall surface,

the means including a sub-means for twisting the molecules about an axis intersecting said at least one wall surface and restricting the molecules so that they will turn in one and the same direction.

2. A mechanism for causing a flow of liquid crystal according to claim 1 wherein:

the channel is defined by a pair of wall surfaces facing each other;

the liquid crystal is put between the paired wall surfaces; and

the sub-means has a pair of orientation films, either of the paired wall surface being fitted with one orientation film, the surfaces of the orientation films being rubbed in the same direction.

3. A mechanism for causing a flow of liquid crystal according to claim 1 wherein:

the channel is defined by a pair of wall surfaces facing each other;

the liquid crystal is put between the paired wall surfaces; and

the sub-means has a pair of orientation films, either of the paired wall surface being fitted with one orientation film, the rubbing direction of the surface of one orientation film being at an angle with the rubbing direction of the surface of the other orientation film.

4. A mechanism for causing a flow of liquid crystal according to claim 1, 2, or 3 wherein the molecules of the liquid crystal are tilted relatively to the wall surface or one of the paired wall surfaces.

5. A mechanism for causing a flow of liquid crystal according to claim 1, 2, 3, or 4 wherein:

the means includes a controller to control the timing in applying an electric or magnetic field to

the liquid crystal and the intensity of the electric or magnetic field; and

the controller applies an electric or magnetic field to the liquid crystal intermittently.

6. An object-moving mechanism comprising:

a fixed lower member;

a movable upper member of which the lower surface faces the upper surface of the fixed lower member and which is movable along the upper surface of the fixed lower member;

liquid crystal put between the upper surface of the fixed lower member and the lower surface of the movable upper member; and

a means for applying an electric field to the molecules of the liquid crystal to turn them in a plane intersecting the upper surface of the fixed lower member,

the means including:

a pair of electrodes, one being fitted to the fixed lower member, the other being fitted to the movable upper member; and

a sub-means which is fitted onto the fix lower and movable upper members and restricts the molecules of the liquid crystal so that they will turn in one and the same direction.

7. An object-moving mechanism comprising:

a fixed lower member;

a movable upper member of which the lower surface faces the upper surface of the fixed lower member and which is movable along the upper surface of the fixed lower member;

liquid crystal put between the upper surface of the fixed lower member and the lower surface of the movable upper member; and

a means for applying a magnetic field to the molecules of the liquid crystal to turn them in a plane intersecting the upper surface of the fixed lower member,

the means including:

a pair of electrodes, one being fitted to the fixed lower member, the other being fitted to the movable upper member; and

a sub-means which is fitted onto the fixed lower and movable upper members and restricts the molecules of the liquid crystal so that they will turn in one and the same direction.

8. An object-moving mechanism according to claim 6 or 7 wherein the sub-means has a pair of rubbed orientation films, one being fitted onto the upper surface of the fixed lower member, the other being fitted onto the lower surface of the movable upper member.

9. An object-moving mechanism according to claim 6, 7, or 8 wherein the sub-means twists the liquid crystal between the upper surface of the fixed lower member and the lower surface of the movable upper member.

10. An object-moving mechanism comprising:

an outer member which has a space in it;

a shaft which is put in the space for free rotation;

liquid crystal which is put between the inside surface of the outer member and the surface of the shaft; and

a means for applying a radial electric field to the molecules of the liquid crystal to turn them in a plane intersecting the axis of the shaft,

the means including:

a pair of electrodes, one being fitted to the outer member, the other being fitted to the shaft; and

a sub-means which is fitted onto the outer member and the shaft and restricts the molecules of the liquid crystal so that they will turn in one and the same direction.

11. An object-moving mechanism comprising:

an outer member which has a space in it;

a shaft which is put in the space for free rotation;

liquid crystal which is put between the inside surface of the outer member and the surface of the shaft; and

a means for applying a radial magnetic field to the molecules of the liquid crystal to turn them in a plane intersecting the axis of the shaft,

the means including:

a pair of electrodes, one being fitted to the outer member, the other being fitted to the shaft; and

a sub-means which is fitted onto the outer member and the shaft and restricts the molecules of the liquid crystal so that they will turn in one and the same direction.

12. An object-moving mechanism according to claim 10 or 11 wherein:

the sub-means has an orientation film laid on the inside surface of the outer member and an orientation film laid on the surface of the shaft;

the orientation film of the outer member is rubbed in the direction at an angle with the axis of the shaft; and

the orientation film of the shaft is rubbed in the direction at an angle with the axis of the shaft.

13. An object-moving mechanism according to claim 10, 11, or 12 wherein the sub-means twists the liquid crystal between the inside surface of the outer member and the surface of the shaft.

14. An object-moving mechanism comprising:

an outer member which has an inner space defined by a pair of horizontal upper and lower wall surfaces;

an inner member which is put in the space to divide it into right and left subspaces and movable right and left along the upper and lower wall surfaces;

liquid crystal which is put in the space; and

a means for applying an electric or magnetic field to the molecules of the liquid crystal to turn them in one and the same direction in a plane intersecting the inside of the outer member,

the means including a sub-means for twisting the liquid crystal about an axis intersecting one of the paired wall surfaces and restricting the molecules of the liquid crystal so that those in the right sub-space will turn in one direction and those in the left sub-space will turn in the opposite direction.

15. An object-moving mechanism according to claim 14 wherein the sub-means has a pair of orientation films, either of the upper and lower wall surface being fitted with one orientation film, the parts of the upper and lower orientation films on the right side of the inner members being rubbed from the left to the right, the parts of the upper and lower orientation films on the left side of the inner members being rubbed from the right to the left.

16. An object-moving mechanism according to claim 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15 wherein:

the means includes a controller to control the timing in applying an electric or magnetic field to the liquid crystal and the intensity of the electric or magnetic field; and

the controller applies an electric or magnetic field to the liquid crystal intermittently.

17. A method of causing a flow of liquid crystal comprising the steps of:

putting liquid crystal in a channel defined by at least one wall surface;

twisting the liquid crystal about an axis intersecting said at least one wall surface and restricting the molecules of the liquid crystal so that they will turn in one and the same direction by using a twisting/restricting means; and

applying an electric or magnetic field to the restricted molecules, the field being in a direction intersecting said at least one wall surface, to turn them by using a field-applying/molecule-turning means.

18. A method of causing a flow of liquid crystal according to claim 17 wherein:

the channel has a pair of wall surfaces facing each other; and

the twisting/restricting means has a pair of orientation films, either of the paired wall surfaces being fitted with one orientation film, the paired orientation films being rubbed in one and the same direction.

19. A method of causing a flow of liquid crystal according to claim 17 wherein:

5 the channel has a pair of wall surfaces facing each other; and

the twisting/restricting means has a pair of orientation films, either of the paired wall surfaces being fitted with one orientation film, the rubbing direction of one orientation film is at an angle with the rubbing direction of the other orientation film.

20. A method of causing a flow of liquid crystal according to claim 17, 18, or 19 wherein:

10 the field-applying/molecule-turning means includes a controller to control the timing in applying an electric or magnetic field to the liquid crystal and the intensity of the electric or magnetic field; and

the controller applies an electric or magnetic field to the liquid crystal intermittently.